

## Endodontic Treatment of a Maxillary First Molar with C- Shaped Canal Configuration: Case Report

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**Abstract:** Successful root canal therapy requires a thorough knowledge of root and root canal morphology. It is generally accepted that the most common form of the permanent maxillary first molar has three roots and four canals. According to the endodontic literature, the C-shaped root canal is most frequently seen in the mandibular second molar. The occurrence of C-shapes in maxillary first molars, however, has only been described in a limited number of case reports. We hereby present a case of a maxillary first molar with a C-shaped canal configuration which was successfully treated endodontically.

**Keywords:** C-shape, maxillary first molar, root canal anatomy, root canal treatment.

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### I. Introduction

Successful endodontic therapy depends on many factors and one of the most important steps in any root canal treatment is canal preparation. Canal preparation determines the degree of control over the complete elimination of root canal contents that is crucial to debridement of infection. Knowledge of the internal root morphology is a complex and extremely important point for planning and performing endodontic therapy. Several anatomic variations existing in the root canal system may contribute to the failure of root canal therapy [1]. The literature describes various root canal morphotypes in maxillary molars. The most common finding is the prevalence of two canals in the mesiobuccal root [2]. However, reports of C-shaped canals in the maxillary first molar are very rare and there have been reports by few authors previously [1].

C-shaped canals may occur in mandibular first molars and maxillary molars but are most commonly found in mandibular second molars [3]. In 2002, De Moor concluded that the probability of observing C-shaped canals in maxillary first molars was as low as 0.091% [2] while in 2006, Cleghorn et al. reported C-shaped roots and canals were found only in 0.12% of the maxillary first molars [4]. The purpose of this report is to present an unusual case of C-shaped canal in the buccal roots of a permanent first maxillary molar which was successfully treated endodontically.

### II. Case Report

A healthy 28 year old female patient presented to the Department of Conservative Dentistry and Endodontics, KLE VK Institute of Dental Sciences Belgaum, Karnataka, with the complaint of pain in the upper right back tooth since one week which was continuous in nature. The past history revealed the patient had undergone incomplete endodontic treatment a week back. On clinical examination, a temporary restoration was seen in relation to the right maxillary first molar. The tooth was tender to percussion. Radiographic examination of the tooth revealed a previously opened access cavity with a radiopaque restoration. The root canals were unfilled. The roots showed a conical configuration. Thickening of the periodontal space was also seen (Fig.1). Hence, the tooth was prepared for endodontic therapy.

The patients' medical history was noncontributory. After local anesthesia, the temporary restoration was removed and access preparation was modified. The pulp chamber was cleaned and rinsed with a 2.5% sodium hypochlorite solution. The pulp chamber floor was then explored to locate the canal orifices, which had not been explored. Three buccal orifices were seen i.e. 2 mesiobuccal and 1 distobuccal which were seen in continuation with each other in a semi-colon configuration. One large palatal orifice was located (Fig 2).

The working length of each of the canals was estimated using an electronic apex locator (Raypex 5, VDW Endodontic synergy, Germany) and then confirmed by a radiograph. The working length radiograph showed 4 canals with the files in all the three buccal canals in the same root converging towards a single apical foramen, (Fig 3) and a separate palatal single canal. Biomechanical preparation of the tooth was done by sequential use of nickel-titanium ProTaper S1, SX shaping rotary file till F2 finishing file (Dentsply Maillefer, Ballaigues, Switzerland). Brushing strokes were used in a circumferential manner to prepare all canal walls. Root canals were irrigated with 3% sodium hypochlorite (Vishal Dentocare Pvt Ltd, Sarkhej, Ahmedabad) and normal saline.

A calcium hydroxide intracanal medicament was placed in the canals and the patient was re-called after one week. In the next appointment, obturation was done using gutta percha and a zinc oxide eugenol sealer (Fig 4), and the tooth was then restored with a composite resin (Filtek P60, 3M/ESPE) (Fig 5)

### **III. Discussion**

The variability of the root canal system of multirooted teeth represents a challenge to both endodontic diagnosis and treatment. The preoperative awareness of potential anatomic variations is essential for the success of the endodontic treatment [2]. Case reports of variations in the number of root canals of maxillary first molars have been published [5, 6]. C-shaped canals, which are considered as one such variation may also be present in maxillary first molars. C-shaped canals were first documented in the endodontic literature by Cooke & Cox (1979) [3]. The failure of fusion of Hertwig's epithelial sheath on the lingual or buccal root surface is the most lucid explanation for the formation of the C-shaped canal configuration. [1, 7] Failure of the Hertwig's epithelial sheath to fuse on the buccal side will result in the formation of a lingual groove, and failure to fuse on the lingual would result in a buccal groove. Hence, this fusion is not uniform and a thin interradicular ribbon connects the two roots together [7].

The main anatomical feature of C-shaped canals is the presence of a fin or web connecting the individual root canals. Roots containing a C-shaped canal often have a conical or square configuration [3]. The C-shaped canal configuration shows an ethnic predilection. It has frequently been reported in countries belonging to the Asian continent [7]. According to De Moor (2002) the probability of observing a C-shaped canal in a maxillary first molar was as low as 0.091% [3], indicating that this type of anomaly is a rare occurrence in the maxillary first molar. A limited number of reports have been described with the existence of C-shaped canals in the maxillary first molars. These teeth provided examples of palatal and distobuccal canals merging to form a C-shaped canal [3].

In the present case, there were three canals located in the buccal and one in the palatal aspect of the pulp chamber. In the buccal root, the mesial and distal canals merged to form a C-shaped canal, which merged towards a single foramina at the apex. The existence of a single, wide palatal root canal was evident.

The pulp chamber in teeth with C-shaped canals may be large in the occlusoapical dimension with a low bifurcation. Alternatively, the canal can be calcified, disguising its C-shape. At the outset, several orifices may be probed that link up on further instrumentation [1]. In a true C-shaped canal, it is possible to pass an instrument from the mesial to the distal aspect without obstruction. In other configurations, discontinuous dentine bridges impede such passage. If a file could not be passed through the isthmus of the pulpal floor during clinical inspection, the practitioner might consider the root canal as being separated, but in the laboratory analysis, these canals might merge just below the isthmus area [8]. The extravagant use of small files and 5.25% sodium hypochlorite solution and deeper penetration with small instruments using sonics or ultrasonics may allow for better cleaning in fan-shaped areas and furcation canals of the C-shaped canal system [1].

The present case indicates that a good diagnosis with proper radiographic evaluation and a thorough knowledge about the variations of root canal configurations are important for the success of endodontic treatment. Though the occurrence of a C-shaped canal in a maxillary first molar is a rare occurrence the clinician should not ignore the chances of its occurrence and treat the tooth with utmost care. Root canal morphology should be examined during treatment taken from different horizontal angles. Recent imaging technologies and the use of operating microscopes may be helpful in detecting variations of root canals.

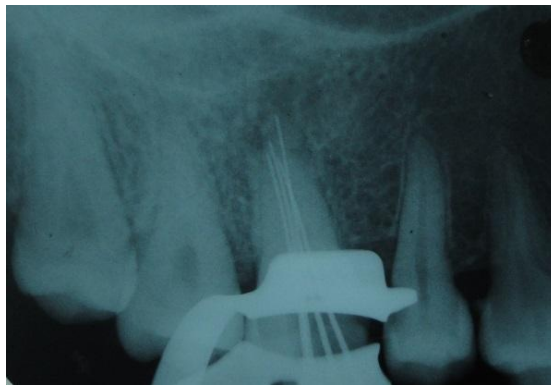
### **IV. Figures**



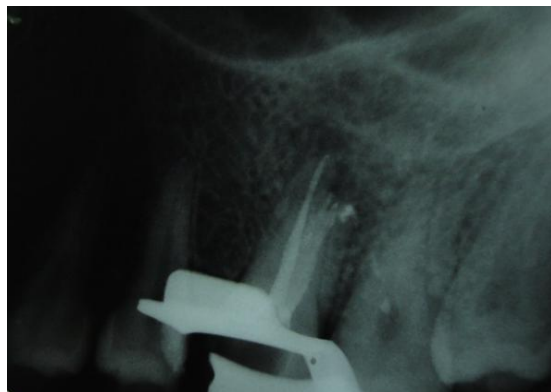
**Figure 1**



**Figure 2**



**Figure 3**



**Figure 4**



**Figure 5**

## **V. Conclusion**

Although C-shaped root canal morphology is commonly reported in mandibular molars, the present case has demonstrated this configuration in a maxillary first molar.

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